MICROESTRUTURAL INVESTIGATION OF OXIDE LAYER PRODUCED ON 5052 ALUMINUM ALLOY USING SODIUM TETRABORATE AS ANODIZING ELECTROLYTE

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1. Introduction

Anodizing is a well-established process for treatment of aluminum and its alloys. Nevertheless, acid-based electrolytes commonly used in anodizing are harmful to the man and the environment. In this sense, it is important and necessary an alternative treatment for aluminum and its alloys using ecofriendly compounds. Plasma-assisted anodizing is a novel process for treatment of light alloys, such as Al, Mg, Ti, etc., which allows the use of alkaline electrolytes based on aluminates, phosphates, borates and others [1]. Besides, oxide layers deposited by plasma electrolysis present different chemical structure and better physical properties [2]. This work present the microstructure of oxide layer deposited on 5052 aluminum alloy from sodium tetraborate electrolyte.

2. Experimental

Plasma electrolysis was performed in a DC electrolytic system (20 kW). Aluminum sample was fixed at the anode, while a stain steel electrode was the cathode. Electrolytic solution was prepared with deionized water, 20 g/l of sodium silicate (Na_2SiO_3) and 2 g/l of sodium tetraborate ($Na_2B_4O_7$). Process parameters were 300 V of voltage and 10 min of bath time. Sample surface was observed by a scanning electronic microscope (SEM), layer chemical composition was evaluated by energy-dispersive X-ray spectrometry (EDX), and phase analysis was performed by X-ray diffraction (XRD) spectroscopy.

3. Results and Discussions

Oxide layer deposited by plasma electrolysis presents a thickness about 1.2 μm. SEM analysis shows a bumpy surface with protuberances, craters and sealed pores as can be seen in Fig. 1. Chemical structure of oxide layer is composed by O, Al, Si, Na and C. This later probably belongs to cathodic electrode, while the rest are from electrolyte. XRD revealed the layer is formed by gamma-alumina (γ-Al_2O_3), but alpha-alumina (α-Al_2O_3), appears in lower amount, as can be seen in Fig. 2.

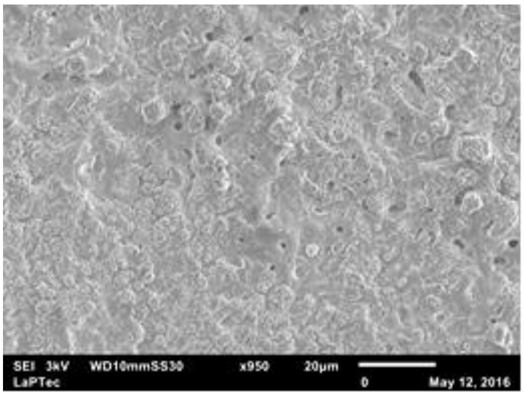

Fig. 1. *MEV micrograph of plasma-anodized 5052 Al alloy.*

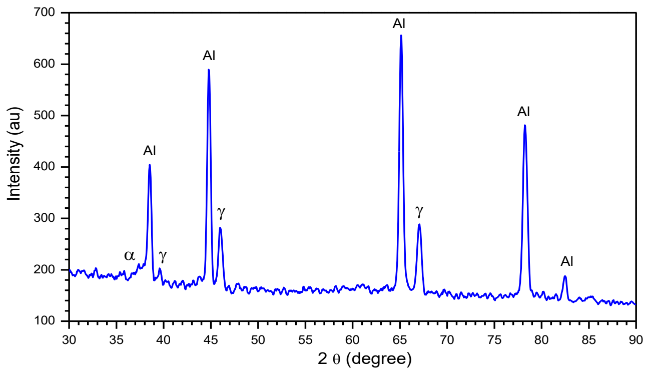

Fig. 2. *XRD analysis of oxide layer deposited on 5052 Al alloy via plasma anodizing from sodium tetraborate electrolyte.*

4. References

[1] Gupta, P. et. al. Surface and Coatings Technology 201 (2007) 8746–8760.
[2] Lugovskoy, A. et al. Applied Surface Science (2013) 743–747.

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